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Case report

A Case Of Propanil Poisoning Managed With Manual Red Cell Exchange

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Abstract

We present a case of propanil poisoning in a 23-year-old male diagnosed with depression and seizure disorder. Initially, the patient was managed with IV methylene blue; however, red cell exchange was indicated as the clinical condition was deteriorating. Facilities were not available to perform an automated red cell exchange. Hence, a manual red cell exchange was arranged, in which the patient's whole blood was withdrawn, and healthy donor red cells were transfused with plasma. After three manual exchanges, the patient improved. This case suggests that red cell exchange is lifesaving in propanil poisoning, which can be accomplished manually.

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Introduction

The aphaeresis technique is used to separate blood components from whole blood in blood component collection and as an extracorporeal therapy. In therapeutic procedures, a specific blood component is removed when that blood component causes a disease condition [1]. Therapeutic cytapheresis removes Pathological cellular components, whereas pathogenic elements with a high molecular in plasma are removed by therapeutic plasmapheresis. In red cell exchange (RCE), the patient's red cells are replaced with donor red cells, and it is indicated in a spectrum of disease conditions [2]. This can be performed manually or automatically. In manual RCE, serial phlebotomies and isovolemic replacement with donor red cells are done in contrast to the automated method, in which this happens with an automated cell separator.

Propanil poisoning is a significant herbicide poisoning, and RCE has been used to treat the condition when not responding to methylene blue treatment [3]. In propanil poisoning, Fe2+ ions are converted to Fe3+ ions, resulting in the formation of methaemoglobin, which has a low oxygen-carrying capacity [4]. Therefore, patients experience tissue hypoxia, and in severe and prolonged cases, this could be fatal. Furthermore, there is direct oxidant damage to red cells as well [5]. Proper management is lifesaving in propanil poisoning, and methylene blue is the drug of choice to treat methaemoglobinaemia in acute settings. However, it should be immediately available, and facilities must be available to monitor methaemoglobin levels continuously. If the clinical condition deteriorates even after the administration of methylene blue, RCE can be considered as it removes red cells with methaemoglobin and supplies healthy red cells, thus improving oxygen-carrying capacity.

Aphaeresis is currently performed with automated cell separators, and different kinds of machines are available. However, in Sri Lanka, every machine is not available island-wide. Therefore, it would be challenging to arrange an emergency procedure when needed. Considering the time taken to transfer the patient to a hospital where the facility is available, there

is a risk for the patient. Hence, arranging a red cell exchange with the available resources is critical to save the patient. Here, we present a case of propanil poisoning, which was treated with manual red cell exchange at a secondary care hospital.

Case Presentation

A 23-year-old male, a known patient with a seizure disorder and depression, was admitted following self-ingestion of approximately 500 ml of a poison, which was identified as propanil later. The patient experienced nausea, vomiting and frothing, and he was brought to the hospital within 45 minutes of ingestion. On admission, his Glasgow Coma Scale (GCS) was 13/15, and he was hemodynamically stable. Oxygen saturation was found to be 96% on room air; however, reduced air entry was noted in both lung bases. Initial management included gastric lavage and administration of activated charcoal. Then, the patient was propped up, and oxygen was administered via a face mask. Intravenous (IV) methylene blue 0.5 ml/kg was given over 5 minutes. The patient was connected to a cardiac monitor, and vital parameters were monitored continuously. IV maintenance fluids were started, and all the supportive treatment was given, including routine antiepileptic drugs. Initial investigations revealed a haemoglobin value of 13.8 g/dL with a hematocrit of 44%. Other investigations were unremarkable. Arterial blood gas analysis showed a pH of 7.34, pCO2 of 28 mmHg, and pO2 of 420 mmHg, with SPO2 of 100.

Initially, the patient was managed at the medical ward with close serial blood gas analysis monitoring. Supplementary O2 via face mask was continued and observed for features of methaemoglobinaemia. One hour after admission, the patient's SPO2 dropped to 87% while on 5 l l/minute of O2 via face mask and significant tachycardia was noted. Therefore, O2 support was increased to 10 l/minute, and a repeated dose of IV methylene blue was given as above. As there was further deterioration, O2 support was increased to 15 l/minute, which achieved a saturation of 99%.

Around 5 hours later, the patient's oxygen saturation dropped again to 86% with high flow O2, with a respiratory rate of 24 breaths per minute. However, other parameters such as GCS, heart rate and blood pressure were normal. IV methylene blue 0.5ml/kg dose was repeated. As the patient was further deteriorating, he was transferred to the medical intensive care unit for further management. Irrespective of repeated IV methylene blue treatment, the patient's oxygen saturation was not improved. Therefore, the patient was referred for therapeutic red cell exchange. Then, exchange transfusion was performed by manual method as an automated cell separator was not available at the hospital. The patient's estimated blood volume was 3500 ml. Vascular access was achieved with a Vascath, and a three-way line was connected. 500 ml of whole blood was initially replaced with 300 ml of group-specific, crossmatch-compatible red cells. The balance was replaced with group-specific plasma. Similarly, a total of 1500 ml of blood was exchanged in the procedure.

On the following day, a repeated full blood count revealed a haemoglobin value of 13.4 g/dL with a haematocrit of 40%. However, the patient's SPO2 was 83% with 15 l/min O2. The blood picture revealed an oxidation-induced haemolysis. IV ceftriaxone was added due to the presence of fever spikes. Arterial blood gas analysis showed a pH value of 7.39. His pCO2 was 21 mmHg, and pO2 was 152 mmHg, with SPO2 of 99. The second cycle of exchange transfusion was arranged. As in the first cycle, 1500 ml of blood was removed intermittently and replaced with crossmatch compatible donor red cells and plasma. After the second cycle, the patient has improved in terms of oxygen saturation, which was found to be stable above 88%, and the oxygen demand has been continuously decreasing. After the second red cell exchange, the haemoglobin value was 11.8 g/dL, the haemoglobin value was 11.8 g/dL, and the haematocrit was 37%. The third cycle of red cell exchange was arranged, and the same values were achieved as for the previous red cell exchange cycles. During the procedure, the patient did not experience any adverse events. Thereafter, oxygen support was gradually tailed off as saturation was improved. After 7 days of MICU management, the patient was sent to the ward, and the patient was haemodynamically stable and saturation maintained on room air.

Discussion

This patient's clinical course, marked by oxygen desaturation irrespective of IV methylene blue treatment, shows the nature of propanil poisoning. Although RCE is beneficial, facilities were not available to perform an automated RCE at the hospital and the decision was made to carry out the procedure manually. As a result of performing three successful manual red cell exchanges, the patient experienced a full recovery.

Propanil is a very potent and widely used herbicide that belongs to the acetanilide group, and it is commonly available as a 36% solution [3]. It has been categorised as a moderately hazardous poison by the World Health Organization [6]. It has shown an 8·2% case fatality rate

in Sri Lanka [6]. Ingestion of around 10 ml of undiluted poison is fatal. The conversion of propanil into 3,4-dichlorophenylhydroxylamine, which is then co-oxidised with oxyhemoglobin in red cells to the ferric state, causes the production and accumulation of methaemoglobinaemia in red cells and reduces the oxygen-carrying capacity [4]. As a result, cyanosis and acidosis occur, and finally organ failure could happen. The rate of methaemoglobin formation is proportionate with the level of toxicity. Clinical features appear soon after the ingestion, and they include nausea, vomiting, diarrhoea, tachycardia, dizziness and confusion. In addition, depression of the central nervous system, hypotension and central cyanosis are features of severe poisoning [4]. Haemolysis is another feature of propanil poisoning due to direct oxidant damage to red cells [5,7]. Hepatitis is also a recognised feature of some cases of propanil poisoning [8]. The half-life of propanil poison is approximately 3.2 hours, and its main metabolite, 3,4-dichloroaniline, has a relatively longer half-life [4]. Therefore, the period of time from ingestion to death is generally more than 24 hours. IV methylene blue is the treatment of choice in methaemoglobinaemia, as it converts methaemoglobin to haemoglobin [3]. The usual dose is 1-2mg/kg. In case of poor response, this can be repeated. The use of ascorbic acid is also beneficial in some cases.

RCE has been shown to be effective in propanil poisoning in many cases [3,810]. It includes the removal of affected red cells and the transfusion of healthy donor red cells. When it is performed using an automated cell separator, both happen simultaneously, and the machine makes the calculations depending on the given parameters. In the procedure, the patient's plasma returns to circulation [2]. Therefore, donor plasma is not given in automated RCE. Vascular access is gained by inserting a central venous catheter, and usually, the procedure is carried out at a high dependency area with close patient monitoring. Automated RCE rapidly corrects the oxygen-carrying capacity by replacing the red cells [3]. Therefore, clinical improvement of the patient is observed immediately. Blood used for RCE must be crossmatched compatible with the patient, and usually, a considerable amount is needed. A disposable kit is used for each procedure, in which blood components are separated. Hence, there is minimal risk of bacterial contamination during the procedure. Adverse events of RCE include haemolytic transfusion reaction due to incompatible blood transfusion, hypocalcaemia due to citrate toxicity, hyperkalaemia, hypothermia and transmission of infectious agents. Furthermore, machine failures could happen. Vascular access-related complications like infections, bleeding, and thrombosis are also possible in apheresis procedures.

When facilities are not available for an automated RCE, the procedure can be performed by manually. In manual RCE, whole blood is withdrawn from the patient manually, and it is replaced with crossmatch compatible blood and group-specific plasma. Plasma can be either transfused separately or added to a red cell pack to match the patient's haematocrit. Every calculation must be made accurately to avoid fluid imbalances. Routinely, an isovolaemic balance is achieved. Even though the plasma volume is replaced by crystalloids or colloids by some clinicians, it has a high risk of developing coagulopathy in addition to other risks due to loss of coagulation factors. Some clinicians have tried serial venesections with red cell transfusion to improve the clinical condition of propanil poisoning [11]. Even though this is similar to manual red cell exchange, it does not replace the plasma volume, which could result in adverse outcomes.

However, this manual method is beneficial when automated RCE is not available. Transferring the patient would take considerable time. Even with a delay, a desirable outcome can be achieved. In our patient, three cycles were needed to stabilise the patient. Furthermore, it could be superior to automated in poisoning cases as it removes plasma as well. However, plasma concentration is variable in propanil poisoning [4]. All things considered, the manual RCE has good therapeutic effect.

Conclusion

Propanil has a high morbidity following ingestion and could lead even to death. This case proves that the red cell exchange is beneficial in propanil poisoning and it improves the condition significantly. Furthermore, the procedure is feasible and cost effective with manual method in resource poor settings.

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Conflict of interest
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Ethics statement
Written informed consent was obtained for participation and publication.

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